

In the Claims

Please add new claims

5. (new) An apparatus, comprising:

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a networking system that executes a series of scheduling cycles in order to allocate switching or routing bandwidth within said networking system, wherein a highest speed grade is identified for a highest amount of allocated bandwidth, and wherein a unique lower speed grade is identified for each unique speed that is less than said highest amount of allocated bandwidth, each of said scheduling cycles partitioned into equal amounts of data, wherein each bandwidth allotment is provided one of said amounts of data per unit of time, wherein said unit of time is one of said scheduling cycles for said highest amount of allocated bandwidth, and wherein said unit of time is more than one of said scheduling cycles for each bandwidth allocation having a lower speed grade such that its lower speed is realized.

6. (new) The apparatus of claim 5 wherein said unit of time is determined with a counting modulo, said counting modulo being:

$x_1 = \min \text{ integer}[B/X]$ for a said highest speed grade bandwidth allotment, where B is said switching or routing capacity of said networking system and X is said highest amount of allocated bandwidth.

7. (new) The apparatus of claim 5 wherein said unit of time is determined with a counting modulo, said counting modulo being:

$x_n = kx_{n-1}$ for a lower speed grade bandwidth allotment, where k is the number of said lower speed grade bandwidth allotments that can be provided by

a next highest speed grade, and where x_{n-1} is the count modulo for said next highest speed grade.

8. (new) The apparatus of claim 5 wherein said networking system said allocates said bandwidth to one or more ports on a port-by-port basis, each of said ports having one or more queues for queueing packet identifiers that point to where a corresponding packet is found within a memory.

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9. (new) The apparatus of claim 8 wherein said networking system can be configured such that one port exists for each user being serviced by said networking system.

10. (new) The apparatus of claim 8 wherein said networking system further comprises a scheduler that provides a release signal to each of said ports, per said unit of time, in order to trigger a release of said one of said amounts of data from said memory, said release from said memory in the form of packets pointed to by those of said packet identifiers stored within said port that receives said release signal.

11. (new) The apparatus of claim 10 wherein said networking system further comprises a second memory that can be configured to maintain a separate data entry for each of said one or more ports, each of said data entries identifying its corresponding port so that a said release signal to be received by said corresponding port can be generated by reading its data entry from said second memory.

12. (new) The apparatus of claim 11 wherein those data entries for each of said one or more ports having the same data rate are circularly link listed so that release signals to ports having the same associated speed grade are generated in a circular fashion.

13. (new) The apparatus of claim 12 wherein each of said data entries further comprises space reserved for at least a bit of information that marks whether or not it is to be recognized as an end of the circular link list to which it belongs.

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14. (new) The apparatus of claim 10 wherein said scheduler is implemented with application specific logic.

15. (new) The apparatus of claim 10 wherein said scheduler is implemented with a processor that executes a software program.

16. (new) A method, comprising:
executing a series of scheduling cycles in order to allocate switching or routing bandwidth within a networking system, wherein a highest speed grade is identified for a highest amount of allocated bandwidth, and wherein a unique lower speed grade is identified for each unique speed that is less than said highest amount of allocated bandwidth, each of said scheduling cycles partitioned into equal amounts of data, wherein each bandwidth allotment is provided one of said amounts of data per unit of time, wherein said unit of time is one of said scheduling cycles for said highest amount of allocated bandwidth, and wherein said unit of time is more than one of said scheduling cycles for

each bandwidth allocation having a lower speed grade such that its lower speed is realized.

17. (new) The method of claim 16 wherein said unit of time is determined with a counting modulo, said counting modulo being:

$x_1 = \text{min integer}[B/X]$ for a said highest speed grade bandwidth allotment, where B is said switching or routing capacity of said networking system and X is said highest amount of allocated bandwidth.

18. (new) The method of claim 16 wherein said unit of time is determined with a counting modulo, said counting modulo being:

$x_n = kx_{n-1}$ for a lower speed grade bandwidth allotment, where k is the number of said lower speed grade bandwidth allotments that can be provided by a next highest speed grade, and where x_{n-1} is the count modulo for said next highest speed grade.

19. (new) The method of claim 16 further comprising allocating said bandwidth to one or more ports on a port-by-port basis by providing a release signal, per said unit of time, to each of said ports, each of said ports having one or more queues for queueing packet identifiers that point to where a corresponding packet is found within a memory, each said release signal provided per said unit of time.

20. (new) The method of claim 19 further comprising triggering a release of said one of said amounts of data from said memory, said release from said memory in the form of packets pointed to by those of said packet identifiers stored within said port that receives said release signal.

21. (new) The method of claim 19 further comprising configuring said networking system such that one port exists for each user being serviced by said networking system.

22. (new) The method of claim 19 further comprising reading a data entry from a second memory, said second memory configured to maintain a separate data entry for each of said one or more ports, each of said data entries identifying its corresponding port so that a said release signal to be received by said corresponding port can be generated by said reading.

23. (new) The method of claim 22 further comprising generating release signals to ports having the same associated speed grade in a circular fashion, wherein data entries for each of said one or more ports having the same data rate are circularly link listed so that said circular generation of release signals results.

24. (new) An apparatus, comprising:

a networking system having one or more ports that each comprise one or more queues for queueing packet identifiers, each of said packet identifiers indicating where a packet can be found in a memory, each of said one or more ports having its own data rate so that a plurality of data rates can exist, said networking system capable of calculating a series of scheduling cycles, each of said scheduling cycles partitioned into equal amounts of data wherein one of said amounts of data per said scheduling cycle corresponds to a highest data rate of said plurality of data rates, and wherein, each of said one or more ports triggers a release from said memory of one of said amounts of data worth of its

identified packets in response to reception of a release signal derived from said series of scheduling cycles, and wherein releases from a same port are separated in time so that said same port's data rate is realized.

25. (new) The apparatus of claim 24 wherein said networking system further comprises a second memory that can be configured to maintain a separate data entry for each of said one or more ports, each of said data entries identifying its corresponding port so that a said release signal to be received by said corresponding port can be generated by reading its data entry from said memory.

26. (new) The apparatus of claim 25 wherein those data entries for each of said one or more ports having the same data rate are circularly link listed so that release signals for a particular speed grade are generated in a circular fashion.

27. (new) The apparatus of claim 26 wherein each of said separate data entries further comprise space reserved for at least a bit of information that marks whether or not it is to be recognized as an end of the circular link list to which it belongs.

28. (new) The apparatus of claim 25 further comprising a scheduler that generates said release signals by said reading of said data entries from said memory, said scheduler coupled to each of said one or more ports so that said release signals can be issued to said one or more ports.

29. (new) The apparatus of claim 28 wherein said scheduler is implemented with application specific logic.

30. (new) The apparatus of claim 28 wherein said scheduler is implemented with a processor that executes a software program.

31. (new) The apparatus of claim 24 wherein said networking system can be configured to allocate one of said ports to each user that is serviced by said networking system.

32. (new) The apparatus of claim 31 wherein said ports and said buffer memory are part of a networking/transport layer within said networking system that can:

- 1) identify which user an incoming packet is to be sent to; and
- 2) enters a packet identifier into a port that has been allocated to said user said incoming packet is to be sent to, said packet identifier identifying where in said memory said incoming packet can be found.

33. (new) The apparatus of claim 32 wherein said networking/transport layer further comprises application specific logic that performs said identifying and said entering.

34. (new) The apparatus of claim 33 wherein said application specific logic further comprises a packet processing pipeline that performs said identifying and said entering.

35. (new) The apparatus of claim 32 wherein said networking/transport layer further comprises a processor that performs said identifying and said entering via execution of a software program.

36. (new) A method for executing a scheduling cycle, comprising:
distributing to each highest speed grade port, while counting, permission to release an amount of data; and
distributing to each of one or more lower speed grade ports, while continuing said counting, permission to release one of said amounts of data, until
said counting has counted across a counting modulo,
wherein each of said lower speed grade port(s) consume less bandwidth than each of said highest speed grade port(s), said counting modulo establishing a temporal width of said scheduling cycle that results in one of said amounts of data per scheduling cycle being the amount of bandwidth allocated to each one of said highest speed grade port(s).

37. (new) The method of claim 36 further comprising recognizing said highest speed grade as an active speed grade prior to said distributing to each highest speed grade port permission to release said amount of data.

38. (new) The method of claim 37 further comprising, in response to said recognizing said highest speed grade as said active speed grade, reading from a memory each data entry within a circular link list, each of said highest speed grade ports represented by one of said data entries within said circular link list, wherein each one of said data entries has a value used to generate a said permission to the particular highest speed grade port that it represents.

39. (new) The method of claim 38 wherein one of said data entries has a second value that indicates it is the last data entry in said circular link list, said reading of said last entry causing a next lower speed grade to be recognized as the active speed grade.

40. (new) The method of claim 39 wherein

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a) said counting modulo is $x_1 = \min \text{ integer}[B/X]$; where, B is the switching or routing capacity of a networking system that executes said scheduling cycle and X is said amount of bandwidth allocated to each one of said highest speed grade port(s); and

b) said counting across said counting modulo causing said highest speed grade to be recognized as said active speed grade for the beginning of a next scheduling cycle.

41. (new) The method of claim 36 further comprising recognizing a particular lower speed grade as an active speed grade prior to said distributing to each of one or more lower speed grade ports permission to release said amount of data.

42. (new) The method of claim 41 further comprising, in response to said recognizing a particular lower speed grade as said active speed grade, reading from a memory each data entry within a circular link list, wherein each of said lower speed grade ports that is allocated bandwidth at said particular lower speed grade is represented by one of said data entries within said circular link list, wherein each one of said data entries has a value used to generate a said permission to the specific lower speed grade port that it represents.

43. (new) The method of claim 42 wherein one of said data entries has a second value that indicates it is the last data entry in said circular link list, said reading of said last entry causing a next lower speed grade to be recognized as the active speed grade.

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44. (new) The method of claim 43 further comprising keeping track of a different counting modulo for each lower speed grade, wherein said counting modulo is a highest speed grade counting modulo and a lower speed grade counting modulo for said particular lower speed grade bandwidth allotment(s) is:

$x_n = kx_{n-1}$, where, k is the number of said particular lower speed grade bandwidth allotment(s) that can be provided by a next highest speed grade, and where x_{n-1} is the counting modulo for said next highest speed grade.